MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022 / 2023

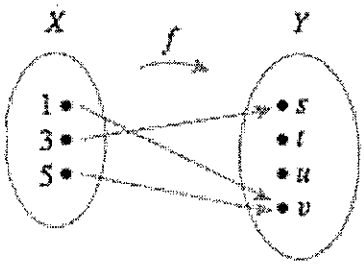
DDS5221 – DISCRETE STRUCTURES

04 JULY 2023
9:00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **TWO (2)** sections, **Section A** and **Section B** with 5 printed pages excluding the cover page.
2. Attempt **ALL** questions in both sections.
3. The distribution of the marks for each question is given.
4. Please write all working steps and answers clearly on the answer booklet provided.

SECTION A: Answer all questions (10 marks)

No.	Question
1.	Given the following statement: $p + q = 3$ Which of the following is TRUE? (1 mark) A. The statement is not a proposition. B. The statement is a true proposition. C. The statement is a false proposition. D. None of the above.
2.	The given compound propositions are logically equivalent. $(p \rightarrow q) \wedge (q \rightarrow p)$ and $(p \leftrightarrow q)$ (1 mark) A. True B. False
3.	Given the relations R on the set $S = \{1, 2, 3, 4\}$. Determine which of the following relations is transitive. (1 mark) A. $R = \{(1, 1), (1, 2), (2, 1)\}$ B. $R = \{(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)\}$ C. $R = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$ D. $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$
4.	Based on the arrow diagram, the range is  (1 mark) A. {s, v} B. {1, 3, 5} C. {s, t, u, v} D. {(1,v), (3,s), (5,v)}

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5. Refer to the algorithm below:

```
1  initial_number = a;
2  next_number = b;
3
4  while (next_number < 30)
5  {
6     new_number = initial_number + next_number;
7     initial_number = next_number;
8     next_number = new_number;
9  }
```

Find the final value for next_number if a = 2 and b = 5. (1 mark)

A. 7
B. 12
C. 19
D. 31

6. How many different words can be made from the letters of the word 'PROCESSES'? (1 mark)

A. 30240
B. 40320
C. 60480
D. 362880

7. In how many ways we can select a student committee of 2 boys AND 3 girls from a group of 5 boys and 8 girls? (1 mark)

A. 56
B. 280
C. 560
D. 1287

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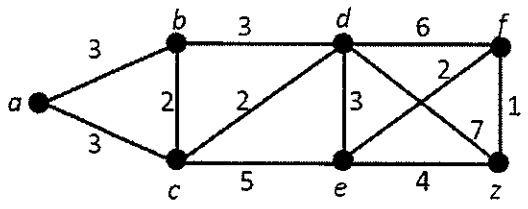
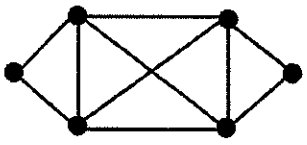
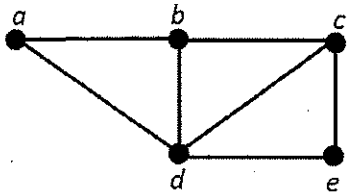
8.	Based on the diagram, find the length of the shortest path between a and z in the given weighted graph.  (1 mark) A. 10 B. 11 C. 12 D. 13
9.	The graph as shown is a complete graph.  (1 mark) A. True B. False
10.	The following graph has no Euler circuit but has a Euler path.  (1 mark) A. True B. False

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SECTION B: Answer all questions (30 marks)

Question 1 (10 marks)

a) Use the Euclidean Algorithm to find the values of s and t that satisfying GCD (57, 81) = $57s + 81t$. (5 marks)

b) By using the Mathematical Induction, verify that the following equation is true for every positive integer n. (5 marks)

$$1^3 + 2^3 + 3^3 + \cdots + n^3 = \frac{1}{4}n^2(n+1)^2$$

Question 2 (10 marks)

a) Given the information: **NEVER GIVE UP AS GREAT THINGS TAKE TIME**

i. Insert the information into a binary search tree. (2 marks)

ii. Search the node **GREAT** by using Depth First Search (DFS) and write out the sequence. (1 mark)

iii. Search the node **GREAT** by using Breadth First Search (BFS) and write out the sequence. (1 mark)

iv. State the height of this binary tree. (1 mark)

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b) Given the finite-state-automaton, $M = (I, S, f, A, q0)$ as follows:

I (input) = {0, 1}

S (a finite set of states) = {S0, S1, S2, S3}

f (transition functions)

State Table

	f	
	Input	
State	0	1
S0	S0	S1
S1	S0	S2
S2	S0	S0
S3	S2	S1

A (the set of accepting states) = {S0, S3}

$q0$ (initial state) = {S0}

i. Construct the state diagram for the finite-state-automaton, M. (4 marks)

ii. Determine whether the input string, 1110 will end at an accepting state. (1 mark)

Question 3 (10 marks)

a) Draw a circuit representing the given Boolean expression:

Q = (A' + B) C' (6 marks)

b) Construct a truth table for the circuit in part (a). (4 marks)

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